A Blueprint for Learning
Gateway Science

The ***Blueprint for Learning*** is a companion document for the Tennessee Curriculum Standards which are located at www.tennessee.gov/education. Although the curriculum adopted by the State Board of Education in its entirety remains on the web for additional reference, this reformatted version makes the curriculum more accessible to classroom teachers.

Gateway Science		
Standard Number:		**1.0 Cells**
Performance Indicators	**Reporting**	**As documented through state assessment -**
State:	**Category**	
		At Level 1, the student is able to
A	**CB**	• identify major cell organelles, given a diagram;
A	**CB**	• distinguish between plant and animal cells, given diagrams or scenarios;
A	**CP**	• predict the movement of water molecules across the cell membrane, given solutions of different concentrations;
A	**CP**	• sequence a series of diagrams depicting the movement of chromosomes during mitosis;
A	**CP**	• compare and contrast the cell cycle in plant and animal cells, given a diagram or description.
		At Level 2, the student is able to
A	**CB**	• distinguish proteins, carbohydrates, lipids, and nucleic acids, given structural diagrams;
A	**CB**	• identify a positive test for carbohydrates and lipids when given an experimental procedure, data, and results;
A	**CP**	• distinguish between active and passive transport, given examples of different molecules;
A	**CP**	• evaluate the role of meiosis in maintaining genetic variability and continuity, given a scenario;
A	**CP**	• determine the number of chromosomes following mitosis or meiosis, given the number of chromosomes in the original cell;
A	**CP**	• recognize the significance of homeostasis to the viability of humans and other organisms, given the definition of homeostasis.
		At Level 3, the student is able to
A	**CB**	• identify the biomolecules responsible for communicating, responding, regulating, or reproducing in the cell.
Performance Indicators		**As documented through teacher observation -**
Teacher:		
		At Level 1, the student is able to
		• demonstrate appropriate use and care of compound light microscopes;
		• examine plant and animal cells using compound light microscopes;
		• create a 3-D model of a typical cell;
		• prepare wet mount slides;

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REPORTING CATEGORY
CB = Cell Organelles and Biomolecules CP = Cell Processes IB = Interactions: Between Organisms and Behavior
IE = Interactions Population Dynamics and Energy Flow PR= Photosynthesis and Respiration G= Genetics
B= Biotechnology/DNA DC= Diversity: Biomes and Classification D= Diversity: Body Systems and Life Cycles

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		• demonstrate molecular movement across a semi-permeable membrane; • model or observe the movement of chromosomes during mitosis in plant and animal cells; • model or observe the movement of chromosomes during meiosis in plant and animal cells; • research careers that relate to the study of cells, such as microscopist, cytologist, oncologist, medical technician, and biochemist; • write a persuasive essay, supported by current scientific journals, to relate certain lifestyle choices to a particular disease; • create a time line that traces the development of microscopes and correlates this information to cytology.
		At Level 2, the student is able to • construct a model of each of the biomolecules, given a structural diagram; • conduct an experiment to identify carbohydrates and lipids; • prepare a slide using proper staining technique; • record nutritional intake for one week, calculating daily caloric intake for each biomolecule, and evaluate the diet to develop an improvement plan; • calculate the ratio of cell surface area to cell volume;
		At Level 3, the student is able to • design and conduct a controlled experiment to observe enzymatic actions and identify possible sources of experimental error; • conduct a test to detect the presence of proteins.

Standard Number :		**2.0 Interactions**
Performance Indicators	**Reporting**	**As documented throughout state assessment -**
State:	**Category**	
		At Level 1, the student is able to
A	**IB**	• identify commensalism, parasitism, and mutualism, given a scenario with examples;
A	**IB**	• classify organisms as producers, consumers, or decomposers, given their behaviors and environment.
		At Level 2, the student is able to
A	**IB**	• identify abiotic and biotic factors, given a description or an illustration of an ecosystem;
A	**IE**	• make inferences about how environmental factors would affect population growth, given a scenario;
A	**IE**	• examine the energy flow and loss through the trophic levels of an ecosystem, given an illustration of an energy pyramid;
A	**IE**	• determine the effects of human activities on ecosystems, given a scenario;
A	**IE**	• analyze and interpret population growth curves, given graphs.
		At Level 3, the student is able to
A	**IB**	• distinguish between a learned and an innate behavior, given a description of that behavior in a scenario.
Performance Indicators		**As documented through teacher observation -**
Teacher:		
		At Level 1, the student is able to

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		• compare and contrast the three types of symbiotic relationships: parasitism, mutualism, and commensalism; • recognize the general conditions necessary to maintain an ecosystem by constructing a model of an ecosystem; • describe the niche and habitat of an organism in an ecosystem; • recognize the kinds of organisms always found at the base of a food chain; • identify the producers, consumers, and decomposers in a food chain; • observe an outdoor habitat, identifying the abiotic and biotic factors, types of populations, producers, consumers, and decomposers; • research careers that relate to the environment, such as urban planner, forester, park ranger, environmental engineer, and environmental lawyer.
		At Level 2, the student is able to • use current publications to research examples where human influence has changed an ecosystem, communicate findings through written and/or oral presentation; • investigate the impact of parasites on human population; • investigate the effects of acid rain on the environment; • maintain a model of an ecosystem; • illustrate the flow of energy through an ecosystem from the sun to producers, consumers, and decomposers; • collect data, construct and interpret population graphs to determine if the population is stable, increasing, or declining.

Standard Number:		**3.0 Photosynthesis and Respiration**
Performance Indicators	**Reporting**	**As documented through state assessment -**
State:	**Category**	
		At Level 1, the student is able to
A	**PR**	• identify the reactants and products of photosynthesis and respiration, given the equations;
A	**PR**	• identify the cell organelle in which photosynthesis occurs, given a diagram of a plant;
A	**PR**	• interpret a diagram of the oxygen-carbon dioxide cycle, given a diagram.
		At Level 2, the student is able to
A	**PR**	• distinguish between aerobic and anaerobic respiration in terms of the presence or absence of oxygen and ATP produced;
A	**PR**	• relate the interdependence of the processes of photosynthesis and respiration to living organisms, given a diagram or a description.
		At Level 3, the student is able to
A	**PR**	• recognize the transfer of energy from respiration to cellular work, given an equation or diagram of the ATP cycle.
Performance Indicators		**As documented through teacher observation -**
Teacher:		
		At Level 1, the student is able to • identify and explore the chloroplasts in a leaf such as *Elodea*; • construct a model or diagram of the oxygen-carbon dioxide cycle;

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		• research careers that relate to photosynthesis and respiration, such as horticulturist, brewer, environmentalist, paper manufacturer and agricultural extension agent; • model or illustrate the paths of water, oxygen, nitrogen, and carbon dioxide through a plant.
		At Level 2, the student is able to • construct charts comparing reactants, products, and energy transfer in photosynthesis and respiration; • demonstrate that oxygen is made during photosynthesis in a laboratory investigation; • sequence the major events of cellular respiration and anaerobic respiration; • investigate the importance of fermentation to the pharmaceutical, agricultural, and food and beverage industries.
		At Level 3, the student is able to • produce concept maps of the major events occurring in the light dependent and light independent reactions; • compare the efficiency of aerobic and anaerobic respiration.

Standard Number:		**4.0 Genetics and Biotechnology**
Performance Indicators	**Reporting**	**As documented through state assessment -**
State:	**Category**	
		At Level 1, the student is able to
A	**G**	• distinguish between asexual and sexual methods of reproduction, using a scenario;
A	**G**	• identify the dominant trait, given the results of a monohybrid cross in a scenario;
A	**G**	• determine the genotype and phenotype of a monohybrid cross, given a Punnet square;
A	**B**	• relate changes in the DNA instructions to cause mutations, given diagrams.
		At Level 2, the student is able to
A	**B**	• recognize the two major functions of DNA as replication and protein synthesis, given diagrams showing a strand of bases with a complimentary strand;
A	**G**	• identify the sex chromosomes in humans and recognize inheritance patterns that are sex-linked, using a pedigree;
A	**G**	• analyze modes of inheritance including co-dominance, incomplete dominance, polygenic, and multiple alleles using genetic problems or Punnet Squares;
A	**B**	• analyze a series of DNA bases to determine the sequence which demonstrates a mutation;
A	**B**	• describe and analyze DNA fingerprinting using an illustration of DNA bands;
A	**G**	• determine the probability of having a child with cystic fibrosis, sickle cell anemia, or Tay-Sachs if both parents are carriers, given a scenario or genetic problem.
		At Level 3, the student is able to
A	**B**	• differentiate the processes of transcription and translation, given diagrams;
A	**G**	• analyze a dihybrid cross given a completed Punnet square to determine the probability of a particular trait.
Performance Indicators		**As documented through teacher observation -**
Teacher:		
		At Level 1, the student is able to • construct a model of DNA;

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		• construct a monohybrid cross given a genetic problem to solve; • distinguish between dominant and recessive traits given the results of a monohybrid cross; • research careers that relate to genetics and inheritance, such as lab technician, forensic pathologist, livestock breeder, medical doctor, and reproductive endocrinologist.
		At Level 2, the student is able to • identify a DNA molecule when given a choice of several structural formulas; • construct a chart comparing DNA with RNA for shape, functions, and molecular make-up; • model the processes of replication, transcription, and translation; • construct a dihybrid cross and predict genotypic and phenotypic ratios; • use a microscope or hand lens to diagram and label different types of reproductive cells; • participate in a classroom debate regarding the scientific and ethical issues surrounding current emerging DNA technologies and/or the Human Genome Project; • model the process of recombinant DNA.

Standard Number:		**5.0 Diversity**
Performance Indicators	**Reporting**	**As documented through state assessment -**
State:	**Category**	
		At Level 1, the student is able to
A	**DC**	• infer animals or plants indigenous to an environment, given pictures or diagrams of the organisms and a description of the environment;
A	**DC**	• infer the biome in which an animal or plant lives, given a description of the organism and pictures of various biomes;
A	**DC**	• infer the relatedness of different organisms using the Linnean system of classification, given pictures of a variety of different plants or animals and a key to classification of organisms.
		At Level 2, the student is able to
A	**DC**	• determine the genus and species of an organism, given a dichotomous key containing descriptions of the characteristic of each classification level;
A	**DL**	• determine whether an insect undergoes complete or incomplete metamorphosis, given pictures or diagrams of the insect in its stages of development;
A	**DL**	• infer the body symmetry of an organism, given a diagram or picture of the organism;
A	**DL**	• predict the function of a system or organ, given structural descriptions, whether in the earthworm, crayfish, frog, or human.
		At Level 3, the student is able to
A	**DL**	• predict the function of an organ, given a description of its component tissues;
A	**DL**	• compare and contrast life cycles of various organisms to include alternation of generations, given pictorial representations.
Performance Indicators		**As documented through teacher observation -**
Teacher:		
		At Level 1, the student is able to • develop a rationale for a system of classification, given a group of objects to classify; • examine plant and animal specimens and compare and contrast their structural components, symmetry, and life cycles;

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		• illustrate or construct a biome for specific plant and animal species by determining the needs of the organisms; • predict the types of plants and animals indigenous to a biome by determining the characteristics of the biome; • research careers that relate to diversity, such as farmer, zoo keeper, pest control consultant, entomologist, taxonomist, lab technician, naturalist, and botanist.
		At Level 2, the student is able to • relate the advantages and disadvantages of various types of classification systems, including the Aristotelian, Linnean, and DNA sequencing systems; • model or observe the stages of complete and incomplete metamorphosis; • model or observe body plans with asymmetry, radial, and bilateral symmetry; • observe or illustrate the alternation of generations in a plant or animal species; • predict the function of a system or organs given the characteristics of the organs contained within that system; • classify a group of organisms, given a dichotomous key with characteristics of the organisms.

Standard Number:		**6.0 Biological Evolution**
Performance Indicators	**Reporting**	**As documented through state assessment -**
State:	**Category**	
A	**IB**	**At Level 1, the student is able to** • differentiate between the relative age of various fossils in sedimentary rock, given a diagram of rock strata;
A	**IE**	• predict how environmental changes will encourage or discourage the formation of a new species or extinction of an existing species, given a written scenario.
A	**DC**	**At Level 2, the student is able to** • transfer knowledge of divergent evolution, as in Darwin's finches, to determine why species with a common ancestor have adapted differently, given a diagram of the various species;
A	**DC**	• compare homologous structures in species to determine the relatedness of certain species, given diagrams or pictures of each;
A	**IE**	• differentiate between natural selection and selective breeding, given a scenario.
A	**B**	**At Level 3, the student is able to** • recognize the relatedness of species using DNA strands.
Performance Indicators		**As documented through teacher observation -**
Teacher:		
		At Level 1, the student is able to • compare and contrast the processes of fossil formation; • construct "mock" fossils using casts and molds; • collect and/or observe various fossils and relate them to biogeographical changes; • research careers that relate to biological evolution, such as farmers, field biologist, geologist, archeologist, epidemiologist, and anthropologist.
		At Level 2, the student is able to • calculate the approximate age of a fossil, given the amount of Carbon 14 atoms found in the fossil and the half-life of C-14;

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		• compare and contrast the homologous and analogous structures of organisms to demonstrate relatedness; • view embryos of different vertebrates to compare their early embryonic development to show relatedness; • analyze a graph of the population distribution of peppered moths as their environment changed; • predict the role of mutations in the survival of a population.
		At Level 3, the student is able to • develop a diorama or time line that depicts change of organisms through time; • collect data from local or regional records regarding population counts of a specific species found in the area and hypothesize what events might affect populations.

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